A CENTURY OF WOMEN'S PARTICIPATION IN THE MAA AND OTHER ORGANIZATIONS

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With over 30,000 members, almost a quarter of them women, the Mathematical Association of America (MAA) is one of the major mathematical organizations in the United States and, indeed, in the world. This brief history of women in the MAA traces how the climate for women in mathematics has changed since the 1890's, when the *American Mathematical Monthly,* the precursor to the MAA, was established [1].

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THE AMERICAN MATHEMATICAL MONTHLY

By the end of the 1890's, there were international, national and local mathematical as well as educational associations. Despite the fact that various mathematical organizations had regular publications, Benjamin Finkel, a teacher at Kidder Institute in Missouri, felt the need for another kind of journal.

1 There are several excellent references that detail the contributions of women mathematicians in the United States prior to 1940, particularly the works of Green and LaDuke, and of Rossiter.

In 1894, Benjamin Finkel and Hannah Cokeley Finkel, his wife, began publishing *The American Mathematical Monthly.* We know very little about Hannah Cokeley Finkel, but she is given credit for actively supporting the *Monthly.* In the December 1912 (volume XIX) *Monthly,* Benjamin Finkel summarizes nineteen years of publishing: "To all these friends, and to Mrs. Finkel, who helped us in the proof-reading of nearly every page, ...we hereby extend our sincerest thanks...". Her support for the *Monthly* is mentioned again in the description of a celebration held for Benjamin Finkel after he had taught at Drury College for forty years.

In his introduction to the first issue of the *Monthly* Benjamin Finkel says that problem solving is an essential part of good teaching and the primary reason for undertaking the monumental task of publishing a new journal. "Most of our existing Journals deal almost exclusively with subjects beyond the reach of the average student or teacher of mathematics or at least with subjects with which they are not familiar, and little, if any, space is devoted to the solution of problems... ."

Each issue of the *Monthly* had about two problems proposed in each of several categories such as arithmetic, geometry, calculus, mechanics, probability, or "Modern Higher Mathematics," and about three solutions to each previously posed problem. A few problems or solutions by women, often students, were published each year. For example, in volume 1 (1894), Grace H. Gridley, a student at the Kidder Institute, presented solutions to two geometry problems and Mrs. Mary E. Hogsett from Danville, Kentucky and Miss Lecta Miller, Professor of Natural Science and Art at Kidder Institute, each prosed problems. The journal also contained a biography and a portrait of a mathematician, two or three mathematical papers, book reviews, a column of queries and information, a column of notes, and an editorial.

Only five of the mathematical papers published in the first 12 years were written by women, although about 24 mathematical papers were published annually. In 1895, there was a mathematical paper by Emma C. Ackerman from Michigan State Normal School on "The Golden Section," and in 1896 she co-authored "On an Interesting System of Quadratic Equations" with Professor E. H. Moore of the University of Chicago. The next two mathematical papers written by women are found in 1903; one by Adelaid Denis, a graduate student from Colorado College, and the other by Ida May Schottenfels, which she had presented earlier to the American Mathematical Society. In 1905 Alice Church of New York City authored

"Tests of Divisibility by 7, 13, and 17." (By 1989, women still constituted less than 10% of the authors of each mathematical journal of the MAA.)

Another feature of the *Monthly* was the "News and Notes" section. Women are mentioned here, as in 1907: "Miss Hazel Anderson received her Master's of Mathematics at the University of Chicago and will be Instructor in Mathematics at Manual Training High School, Indianapolis, Indiana. Miss Mary E. Wells, Master's in Mathematics from the University of Chicago, returns to be Instructor in Mathematics at Mt. Holyoke college where she graduated in 1906." A Note in 1910 reads, "Emma M. Cowles, Milwaukee Downer College, is a Speaker for the Committee on the International Commission to the Teaching of Mathematics at the Mathematics conference at the University of Chicago."

A Note in the April 1912 *Monthly* shows an interest in the numbers of women in mathematics: "According to the latest Annual Register of the American Mathematical Society, about 50 of the 668 members are women. It is interesting to observe that the American Mathematical Society has a much larger percent of women members than the leading mathematical societies of Europe. According to the latest register of the German Mathematical Society...only 5 of its 759 members are women; and only one of these 5 members is a German woman, while three of them are Americans and the remaining one is a Russian [2]. The French Mathematical Society also has very few women members. The numbers of women members of the Circolo Matematico di Palermo and of the London Mathematical Society are considerably larger but they are much smaller than in our own society."

Charlotte Angas Scott

A highly visible role model in the United State was British Charlotte Angas Scott, department chair at Bryn Mawr from its opening in 1885 until 1931 [3]. To encourage mathematical research Scott helped found the American Mathematical Society [4] in the early 1890's. Scott was a highly respected leader in the mathematical community, and an inspiration to women. Seven women received their mathematics Ph.D.'s under her guidance.

MATHEMATICAL ASSOCIATION OF AMERICA: THE FOUNDING TO THE 1940'S

At the end of December, 1915, ten women and 96 men met at Ohio State University, where they agreed on the need for an organization that would address mathematical issues of interest to college teachers. The name, Mathematical Association of America, was chosen, and the *American Mathematical Monthly* was adopted as the official journal of the association. (It is most unusual for the official journal of an organization to precede the formation of the organization by twenty years.) The only woman in the organizational structure was Helen Abbott Merrill, one of the 16 associate editors appointed to the *Monthly*.

Helen Abbott Merrill (B.A. from Wellesley College in 1886, further study at the University of Chicago and Göttingen, Ph.D. from Yale in 1903) taught at Wellesley from 1893 and held an endowed chair of the Department of Mathematics (1916-1932). She was very active in the MAA. In addition to serving as Associate Editor of the Monthly from 1916 to 1919, she was a member of the Executive Council from 1917 to 1920, and vice-president in 1920 (Green and La Duke, 1988 and Siegel and Finley, 1985).

Almost ten years passed before the next women became associate editors of the *Monthly*: Elizabeth Carlson (from 1927 to 1931) and Helen Brewster Owens (from 1936 to 1938). Helen Brewster Owens, a mathematics teacher in Ithaca, New York (where here husband was a professor), left her job for a year to organize the successful "votes for women" campaign in Kansas in 1912, and again, though less successfully, in New York in 1915. (Another mathematician activist was Susan Cunningham, Professor Emerita of mathematics at Swarthmore College, where she had been one of the original faculty in 1863, who was reportedly an "ardent suffragist" until her death in 1921 [Rossiter, p. 116].)

The original organization of the MAA, as founded in 1915, consisted of a Nominating Committee of five, and the offices of President, Vice President, Secretary-Treasurer, and twelve additional members of the Executive council. The Standing Committee on Finance consisted of the President, the Secretary and the Managing Editor. All were men, as were all members of the various special committees.

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2 We know who the German woman was; apparently Emmy Noether's isolation was more complete than that of her American peers.

3 Scott was born in England in 1858. In 1880, because she was a woman, she had to receive special permission to take informally the Tripos, the mathematics exam at Cambridge. She scored so high that the resulting publicity caused Cambridge to change its policies (Kenschaft, 1987).

4 The American Mathematical Society (AMS) preceded the MAA by more than two decades. The AMS was founded in the 1890's to encourage mathematical research; the emphasis of the MAA is on college mathematics. Members of the MAA have frequently been members of the AMS, and meetings of the two organizations often were, and are, held jointly. In 1990, however, there is only about one third overlap in membership.

The MAA Board of Governors supervises the scholarly and scientific activities of the Association. The board consists of the officers, the ex-presidents for six years after expiration of their presidential terms, the members of the Finance Committee, and additional elected members called "Governors." Each of the twenty-nine "Sections" of the MAA is entitled to elect a Governor to the board. Women's activities in the Sections are outlined below, and the names of women Governors are listed in Appendix II.

About twelve percent of the over 1000 charter members were women, and they represented a variety of institutions. the two largest contingents were seven women from Wellesley and six from Iowa State College of Agriculture. Two of these Wellesley women, Helen Abbott Merrill (mentioned above) and Clara Eliza Smith, eventually became Vice Presidents of the MAA (Green and LaDuke).

Clara Eliza Smith Served on the MAA Board of Governors from 1923 to 1926 and as a Vice President in 1927. Smith received her Ph.D. from Yale in 1904. She spent her career at Wellesley and co-authored textbooks with her colleague Merrill. The careers of Merrill and Smith were detailed by Green and LaDuke (1988).

Another early active member was Anna Johnson Pell Wheeler. After studies at the University of Iowa and Radcliffe College, Wheeler was awarded the distinguished Alice Freeman Palmer Fellowship by Wellesley College in 1906. A requirement of this fellowship was that she promise not to marry during the

Wellesley College Mathematics Department 1928. Back row l-r: Helen Abbott Merrill, Clara Eliza Smith, Jessie Esther Comegys, Mabel Minerva Young. Front row: Marion Elizabeth Stark, Mary Curtis Graustein, Lennie Phoebe Copeland.

award period. She used the award to pursue a Ph.D. at Göttingen [5], where her mentor, Hilbert, apparently rejected her thesis. She submitted it to the University of Chicago and was graduated magna cum laude in 1910.

She then discovered that women were unacceptable candidates for most college or university positions. Finally, in 1918, after nine years of heavy teaching loads at Mount Holyoke College that left little time for research, she began a 30-year career at Bryn Mawr College, succeeding Charlotte Scott as department chair in 1924 and gaining the high regard of professional mathematicians throughout the country. Wheeler encouraged her students to be active in research and to use professional organizations to further their careers.She published in functional analysis, served on the AMS Council (1924-26), and was the first woman to give an AMS invited address (1923) and also a Colloquium lecture (1927). (AMS invited lectures began in 1895).

In 1933, Wheeler and others managed, with the help of the Rockefeller foundation, to bring the famed German mathematician Emmy Noether to Bryn Mawr. Fellowships provided postdoctoral support for Grace Shover Quinn, Olga Taussky Todd, and Marie Weiss to work with Noether at Bryn Mawr. Marie Weiss became one of the associate editors of the *Monthly* in 1943 and was a National Research Council Fellow from 1928 to 1930. She worked actively in algebra and was a professor at Newcomb college, Tulane, until her death in 1952 (Green and LaDuke, 1988).

Olive Cleo Hazlet, a colleague of Wheeler's at Bryn Mawr in 1918, received her Ph.D. from Chicago in modular invariants and linear associative algebras under Dickson (1910), and spent a year as a post-doctoral fellow at Harvard. Her professors termed her "one of the two most noted women in America in the field of mathematics."

Hazlet took an associate professorship at reduced pay at the University of Illinois in 1925, where she expected to have more opportunity for research. However, she was required to teach large 'service courses' to nonmajors. In 1933, her salary was reduced from $4,000 to $3,500; unlike the rest of the members of her department, her salary was not raised again after the depression. One result was that she retired on a pitiable pension. She died in 1974 (Rossiter, 1982).

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5 There has been significant European influence on mathematics in America. In the 1890's, in the 1930's, and after each world war, many European mathematicians came to live and teach in the United States. It was quite common for Americans to do at least some, if not all of their graduate work in Europe, particularly at Göttingen, where in the 1890's Felix Klein received permission to admit American women–as an experiment–prior to admitting German women.

One of the most active women in the MAA has been Mina Rees, who served on numerous committees and became vice president in 1963. In 1961, she was given the first MAA Award for Distinguished Service to Mathematics.

Mina Rees

Mina Rees faced the discouragement that many women experience during their education. Her family was relatively poor. She west to Hunter High School and graduated summa cum laude from Hunter college. She began to study at Columbia, but "When I had taken four of their six graduate courses in mathematics and was beginning to think about a thesis, the word was conveyed to me—no official ever told me this, but I learned—that the Columbia mathematics department [6] was really not interested in having women candidates for Ph.D.'s. This was a very unpleasant shock...I decided to switch to Teacher's College and take the remaining courses necessary for an M.A. there. A few years later, after I'd saved enough money, I went to Chicago [7]. That was the only episode that raised a question about the appropriateness of mathematics as a field for women before I had my Ph.D. It was really a traumatic affair for me. Of course, this is certainly not at all true of the mathematics department at Columbia now" (Albers and Alexanderson, 1985).

Until quite recently, few men would agree to be an advisor for a female graduate student and women had to adapt their research interests to those who would. Statistics by LaDuke and Green show that almost half of the Ph.D.'s in mathematics granted to women before 1940 in the U.S. were awarded in the 1930's, and 155 of them by only nine schools. Furthermore, only eight mathematicians served as advisors for more than one-third of the 229 degrees: Gilbert Ames Bliss at the University of Chicago, A.B. Coble at Johns Hopkins, L.E. Dickson at the University of Chicago, Aubrey Landry at Catholic University (a student of Morley's), Frank Morley at Johns Hopkins (a friend of Scott's), Anna Pell Wheeler and Charlotte Scott, both at Bryn Mawr, and Virgil Snyder at Cornell. (All except Anna Pell Wheeler, Charlotte Scott, and Aubrey Landrey served at some time as president of the AMS, suggesting that they had the status to mentor students from a less welcome group [Archibald].) Ninety-one of the degrees were granted in the 1920's and twenty-seven in the 1930's.

When a woman did manage to obtain a Ph.D., she usually found employment restricted to a few high schools and women's colleges, with pay considerably lower than men's. Employment was almost nonexistent during the Great Depression of the 1930's (Niven, p 215-216). Because of nepotism laws, many women mathematicians (who tend to marry mathematicians) were unable to secure paying jobs and taught on a volunteer basis.

One example is Sophia H. Levy, a member of the mathematics faculty at the University of California, Berkeley. Sophia Levy was a founding member of the Northern California Section, served as Secretary pro tem at the organizational meeting, and was elected vice-chair. In 1941, she organized a joint committee on education with the Southern California Section. Eventually she married John McDonald of the Berkeley mathematics faculty. "It was not until McDonald's retirement that she could marry him, due to the nepotism rules in effect at that time" (Alexanderson and Klosinski).

Until relatively recently, married women mathematicians usually could work only as research assistants or part-time faculty. Jean Pedersen, the first woman to teach in the Mathematics Department at Brigham Young University and subsequently the first woman to teach in the Mathematics Department at Santa Clara University, wrote that it helped her to hear Mary Ellen Rudin describe her "fractional appointment" rather than her "part-time position." By the 1980's, a few schools (including Wells college in New York and Smith College) hired a wife and husband jointly to fill one position, and it was possible to have a wife and husband both at the same university and even in the same department.

Mary Winston: One of the early American women mathematicians to study in Europe. Back row l-r: Charles Jaccottet, Paul Heegard, Gino Fano. Front row: Mary Winston, Grace Chisholm.

6 In 1886 Columbia University awarded a Ph.D. in Mathematics to Winifred Edgerton.

7 The professional status of women was high in the 1920's. Twenty-six women received Ph.D.'s in mathematics from the University of Chicago between 1920 and 1935, and many of the graduate students were women (Duren).

THE 1940'S TO THE 1960'S

World War II provided some women, most notably Grace Murray Hopper and Mina Rees, with unprecedented career opportunities. Grace Murray Hopper, Ph.D. from Yale in 1934, joined the U.S. Navy and became a pioneer in the development of higher level programming languages. Mina Rees served with the Office of Naval Research and is recognized as having been a guiding force behind government support of mathematical research. In 1953, the council of the AMS adopted a resolution citing her influence which reads, in part, "Under her guidance, basic research in general, and especially in mathematics, received the most intelligent and wholehearted support. No greater wisdom and foresight could have been displayed and the whole postwar development of mathematical research in the United States owes an immeasurable debt to the pioneer work of the Office of Naval Research and to the alert, vigorous and farsighted policy conducted by Miss Rees" [*Bulletin* AMS 60 (1954) p. 134].

During the war, women were allowed to take jobs, including mathematics teaching positions, on an "emergency basis, " but many were dismissed afterward. After the war, many men used G.I. benefits to return to school. Many world-class European mathematicians had found refuge in the United States, and mathematical research developed as a result of war needs. Women did not participate in these mathematically exciting times to the extent that they did both before and afterward. Public opinion told them to return to their homes. The percentage of women receiving American mathematics Ph.D.'s dropped to an all-time low of 5% in the 1950's.

The McCarthy era hurt women as well as men. Pauline Sperry was the first woman Assistant Professor in the mathematics department at the University of California at Berkeley. In 1931, she complied a bibliography of over 200 items on projective differential geometry. She was promoted to Associate Professor in 1932. Known as a great educator, she taught navigation to the Reserve Officers Training Corps in 1949, and helped organize the Women's Faculty Club. Pauline Sperry's career ended in 1949 when she refused to sign the California Regents' Oath, a non-communist oath that was a condition for employment. She, like many others, was fired from her job for this defense of academic freedom (Fasanelli in Grinstein and Campbell). The Committee on Tenure of the Academic Senate resigned because of the pressure by the University to have faculty sign loyalty oaths. Some tenured people were fired, and some resigned in disgust.The California Supreme court late declared the oath unconstitutional, and, in 1956, Sperry was reinstated emeritus and her back salary was paid [8].

8 The "Red-Hunt" is described by Chandler Davis and also by J. L. Kelley.

Students were not immune to the "Red-Hunt." Rebekka Struik, a graduate student at the University of Illinois in 1950, was asked to leave and her fellowship at Northwestern was withdrawn, presumably because her father, Dirk, a mathematician at MIT, was being investigated for "conspiracy to overthrow the Commonwealth of Massachusetts." The case was dismissed in 1955, and she is now Professor of Mathematics at the University of Colorado.

THE 1960'S AND THE 1970'S

In the 1960's, women continued to hold only "fractional" positions. Mary Ellen Rudin, who earned her Ph.D. in 1949, under R.L. Moore at the University of Texas, is the author of more than seventy research papers, primarily in set-theoretic topology. In 1971, she began a term on the Council of the AMS, the

Mary Ellen Rudin

first woman member in over forty years. She is active in both the MAA and the AMS and was vice president of the AMS in 1981-82. She describes the 1950's as the "housewives' generations" with women mathematicians being well-trained amateurs. "I didn't even think of mathematics as a career. The University of Rochester hadn't known I was coming with Walter, but they immediately gave me a calculus class to teach, so I taught. I had a private office. I didn't really have a position, but–oh well–I was a temporary part-time something. And that's the kind of job I have had almost all my life until 1971, when I became a full professor. I have had non-jobs wherever we happened to be" (Albers and Reid, 1988).

One of the few exceptions to this pattern was at the University of Rochester. In 1961 Leonard Gillman, then chair of its Department of Mathematics, hired both Dorothy Maharam Stone, and her husband, Arthur Stone, as Full Professors.

However, many graduate advisors were saying to women: "What makes you think you're worth educating? You're a woman, and you're already married." Simultaneously, *The Feminine Mystique* by Betty Friedan, was published and changed many lives. Louise Hay says, "When I read it, I questioned for the first time the rationale of giving first priority to being a wife and mother, and sacrificing a career for myself for the sake of my husband's" (Hay).

THE ASSOCIATION FOR WOMEN IN MATHEMATICS

Anne Leggett

As the women's movement resurfaced in the late 1960's, women mathematicians began openly expressing their concerns about the discrimination they faced. They discussed discrimination in groups on their campuses and at joint MAA and AMS meetings. In 1971, the Association for Women in Mathematics (AWM) was formed to encourage women to enter careers in mathematics and related areas, and to promote equal opportunity and equal treatment of women in the mathematical community. Mary W. Gray of American University, a pioneering spokeswoman, was elected the first president of AWM (1971-73) and produced its first newsletters. Alice T. Schafer of Wellesley succeeded her in 1973-75 and established the AWM office at Wellesley college, where she was a professor.

AWM has grown to a membership of over 2700. It is independent, but holds joint national meetings with the MAA and AMS. At its January, 1980, meeting, AWM inaugurated the Emmy Noether Lecture Series, given annually at the MAA-AMS-AWM winter meeting by a distinguished woman mathematician.

The AWM has been a major force in uniting women mathematicians. Bettye Anne Case has been its dynamic Meetings Director since 1973. Its publication, the *AWM Newsletter*, has been edited by Anne M. Leggett since 1975, and is a source of abundant information about women's mathematical contributions and issues.

Bettye Anne Case
AWM Meetings Director

THE JOINT COMMITTEE ON WOMEN IN MATHEMATICS

Another force for change came in April, 1971, when the Council of the American Mathematical Society voted to appoint a Committee on Women in Mathematics with the following charge:

> To identify and to recommend to the Council those actions which, in their opinion, the Society should take to alleviate some of the disadvantages that women mathematicians now experience and to document their recommendations and actions by presenting data.

The Committee compiled statistics which "reveal that many stereotyped beliefs about women in mathematics are not at all valid–such as, that they are a poor investment and abandon mathematics or, even worse, that they are not quite human." The Committee's opinion was that the main problem for women in mathematics "still lies in dealing with this stereotype view from their earliest years of learning through the period of deciding on a career, training for it, and, finally, facing employment situations both in hiring and in promotion."

The Committee recommended that the AMS "use its best efforts to encourage advisors and employers to avoid disparaging sex-oriented remarks...to encourage women to use their maiden names professionally, and to support the abolition of questions regarding marital or parental status on employment applications."

The Committee recommended that the AMS work actively for equal opportunities for women in recruitment, employment, advancement, tenure, admissions to graduate schools, fellowships and assistantships and in membership on advisory boards and panels; and that the AMS include more women on AMS programs, committees, governing boards and as invited speakers.

In 1972, the Committee submitted a questionnaire to about 650 women Ph.D.'s in mathematics and profiled a median picture of an American woman mathematician based on their findings:

> She was born in the U.S.A. and received her Ph.D. before the age of thirty and within the last five years. She is married and has children. Her husband is also a mathematician and supports her professional efforts enthusiastically. Her job prospects are limited because she cannot move unless her husband gets a suitable job. However, she has roughly achieved what she set out for, feels perfectly competent and is reasonably content about her future. Her salary is considerably lower than her male

colleagues, in general, but she is satisfied to be an assistant professor at a four year college or university. There is a one in four chance that her husband would not be employed there, too, because of nepotism rules. The school is almost certainly not one of the prestigious schools. If her present occupation is not up to her expectations, she feels that this is not due to prejudice but to her lack of mobility and her family obligations. But she believes there is still prejudice and she would prefer prospective employers to avoid questions about her domestic, marital or parental life.

(Report of the Committee on Women in Mathematics, 1972)

Carole B. Lacampagne

While chaired by Carole Lacampagne (1984-87), the original AMS Committee on Women became a joint committee of the major mathematical societies and adopted its present role as collector of statistics about women in mathematics. Now called the Joint AMS-AWM-ASA-AMS-MAA-SIAM Committee on Women in the Mathematical Sciences, it was chaired by Betty Lichtenberg of the University of South Florida from 1987 to 1989 and now by Sue Geller of Texas A&M University. One of its goals in the 1990's is to determine why students of both sexes who are enrolled in graduate mathematics programs do or do not complete their degrees.

THE WOMEN AND MATHEMATICS PROGRAM (WAM)

By the mid-seventies, the women's movement had begun to raise public awareness of discrepancies between men's and women's job opportunities, salaries and advancements. Betty Vetter reported that the higher paying, higher prestige jobs were generally those that required some mathematics.

Researcher Lucy Sells found that mathematics served as a "critical filter" for women. Her work showed that 92% of the women (in contrast to only 43% of the men) in the 1972 freshman class at the University of California at Berkeley lacked the high school mathematics background that would make them eligible for the standard freshman calculus sequence. Therefore, unless these women undertook remedial work, they were limited in their choice of college major to five fields—humanities, music, social work, elementary education, or guidance and counseling (Ernest, p.9).

In an effort to encourage 9th and 10th graders to keep their options open by taking high school mathematics courses, the Women and Mathematics Secondary School Program was started by the MAA in 1975, funded primarily by IBM. the desire to have women mathematicians speak to secondary school students, parents, and guidance counselors came partially from the realization that there had been no women among the winners of the U.S.A. Mathematical Olympiad. This annual contest, begun in 1972, determines the U.S.A. team for the International Mathematical Olympiad.

The original grant proposal for WAM was written by Mary Gray with the support of Alfred Willcox, Executive Director of the MAA. The program began with director Eileen Poiani and three regional coordinators: Susan Devlin, New York/New Jersey/Connecticut; Mary L. Boas, Greater Chicago; and Jean J. Pedersen, San Francisco Bay Area. Carole B. Lacampagne was National Director from 1981 to 1988, when Alice J. Kelly assumed this leadership. WAM has now expanded to twenty regions around the country.

Mary Gray
Author of the original
grant proposal for WAM.

Since its inception, representatives of Women and Mathematics have visited over 2,600 schools and thus reached over 201,000 students and more than 26,000 teachers, counselors, parents and other adults. WAM speakers often participate in the Expanding Your Horizons program for women. In addition, two women have been winners in the U.S.A. Mathematical Olympiad, most recently Elizabeth Wilmer of New York City, in 1987.

AFRICAN AMERICAN WOMEN IN MATHEMATICS

Until the end of the 1960's few blacks participated in the mathematical organizations because in the South, where most black mathematicians were concentrated, meetings were held in segregated facilities that excluded them. In December, 1951, Lee Lorch, who had joined the mathematics

faculty of Fisk University the previous year, wrote to the Board of Governors:

> ...the Association has the task of promoting the interests of collegiate mathematics, which includes bringing teachers of collegiate mathematics into active participation in the work of the Association.

> Here it should be realized that nearly all Negroes teaching collegiate mathematics are employed in the segregated schools of the south. There are few exceptions...The Secretary of the southeastern region of the Association told me that no Negro had even attended an Association meeting in that region in the twenty years he has been Secretary until some Fisk faculty and graduate students went last spring(and were excluded from the banquet). I suspect that a similar report could be made in respect to the Society.

> Negro mathematicians are naturally reluctant to attend meetings held at schools with which they have virtually no other contact. They feel concerned lest they be excluded, segregated, restricted in their activities, or otherwise humiliated. Those who teach in the state colleges for Negroes have the additional worry that their Boards of Trustees would take punitive action against them if they are involved in an "incident."

> The southern meetings seem to have been organized around the assumption that no Negroes will attend...Precise by-laws are needed to extend to all members the full benefits restricted to some by present practices...Interracial arrangements committees for southern meetings would also help since they would anticipate (and could therefore eliminate) a number of problems that might otherwise prove bothersome (Lorch in Newell, et. al., p. 312-313).

Evelyn Boyd Granville

On February 1, 1952, MAA President Saunders MacLane wrote a memo to all the Section Officers in the country reporting a recent resolution of the board of Governors urging that the Association "promote the interests of Mathematics without discrimination as to race, creed or color." He added that he and the board had determined that it "is possible to...conduct the scientific, business and social affairs of the Association without discrimination as to race, creed or color..." (MacLane in Newell et. al. p. 316).

At this time one of Lorch's colleagues in the Fisk University Mathematics Department was Evelyn Boyd (now Granville), who had become one of the first two African American women ever to earn a Ph.D. in mathematics, both in 1949. The other was Marjorie Lee Browne. both went north to earn their doctorates, Boyd to Yale University and Browne to the University of Michigan; there was no institution in the south where an Afro-American could earn a doctorate.

Marjorie Lee Browne

Although Lee Lorch spent only five years (1950-55) at Fisk University [9], four students who studied with him during that time are now apparently the only graduates of Fisk to hold a Ph.D. in mathematics. Three of these four were women: Etta Falconer, Vivienne Malone Mayes, and Gloria Conyers Hewitt. Another of His Fisk students, Joyce Venable Gould, holds a doctorate in mathematics education (Mayes, 1976).

Lorch's initiative in recommending Gloria Conyers Hewitt for doctoral programs netted her two offers without her even applying. (Her first two years at Fisk had coincided with Lorch's last two.) She accepted the offer of the University of Washington, where she was welcomed by her (all white male) colleagues and her thesis advisor. She thus became the third African American women to earn a doctorate in mathematics in the United States in 1962. (In 1960, both Georgia Caldwell Smith and Argelia Velez-Rodriguez had completed their requirements for a doctorate in mathematics from the University of Pittsburgh and the University of Havana, respectively. However, Smith died before the degree was conferred on her, and Velez-Rodriguez did not come to the United States until 1962.) Later Hewitt became active as a Visiting Lecturer for the MAA and was on the college board Advanced Placement Calculus Development Committee.

Gloria Conyers Hewitt

The experience of Vivienne Malone Mayes was more typical than Hewitt's. When Mayes was a graduate student in the 1950's at the University of Texas at Austin, she could not become a teaching assistant because she was black. One professor would not allow blacks to attend his classes. She could not discuss mathematics with her advisor and other classmates over coffee because they went to a segregated cafe. Only after standing on picket lines in a successful attempt

Vivienne Malone Mayes

to desegregate the cafe racially did she discover that women, whatever their race, felt unwelcome inside. She wrote, "I was the only black and the only woman. For nine weeks thirty or forty white men ignored me completely" (Mayes, 1975).

Most accounts by Kenschaft of black women who earned doctorates in mathematics before 1980 indicate similar isolation and struggle. Kenschaft observed that every woman had not only great intelligence and diligence but also both a family member willing to sacrifice for her career and a secondary school teacher who had told her in effect, "You are excellent in mathematics. It would be worth your struggle to attain a career in mathematics" (Kenschaft, 1981).

Nevertheless, the proportion of women among African American mathematicians is greater than their proportion among white mathematicians, probably because the families of black girls expect them to earn money throughout their lives; the only question is how (Mayes, 1975). Thus a young black woman may feel less ambiguity than her white classmate about attaining as much education as her family can afford; the family believes she will "use" it as much as her brothers would. Several black women mathematicians have told Kenschaft that racism was a greater problem than sexism before earning their Bachelor's degree, after which sexism was the greater problem.

Etta Falconer
First Director of BAM

The lack of support for aspiring black mathematicians, evinced in the 14-year gap (1949-1963) between the second and third black women to receive a doctorate in mathematics is evinced in a statement by Walter Talbot, the fourth black man to do so. He wrote in 1973 that 35 years elapsed after his earning his doctorate in 1934 before "I had a chance to start existing in the national activities of the mathematical bodies." In April, 1969, a conference at Morgan State College, financed by the Ford Foundation, brought together 26 black mathematicians. "That conference was significant because it provided the first realistic opportunity for black Ph.D.'s in mathematics to meet each other, and in some cases to discover each other's existence." Richard Anderson and Creighton Buck attended the conference as consultants and helped bring the others into MAA and AMS activities.

Out of this conference was born the National Association of Mathematicians, as it is now known, officially at the Joint Mathematics Meetings in 1970. Harriet Walton of Morehouse college has been Treasurer since 1980 and Geraldine Darden served as treasurer for several years just preceding her. Etta Falconer received the award for outstanding service in January 1988. NAM holds annual dinners, programs and meetings and recently has been publishing proceedings after each Joint Meeting. It provides a network of active black mathematicians and outreach to prospective ones.

Meanwhile, in 1975 the MAA began a program, Blacks and Mathematics (BAM), similar to WAM with the goal of encouraging black students in mathematics. Etta Falconer was the first director of BAM, ably assisted

Gloria F. Gilmer

by Della Bell as area coordinator in Houston Texas. Gloria Gilmer was the second director. Both Falconer and Gilmer were among those who received awards for outstanding service to minorities at the May 1990 conference on Making Mathematics Work for Minorities (mentioned below). Several black women mathematicians were active in BAM, but the program faded. A task force was formed to study the problems of minorities in mathematics and potential structures to help. In 1989 it produced a report with 42 recommendations, including the establishment of a special office at MAA headquarters. SUMMA, Strengthening Underrepresented Minority Mathematics Achievement, already is open.

Another recommendation was for an MAA Standing Committee on Minority Participation in Mathematics. Major work lies ahead for this committee. Of the 200 Afro-American youngsters who obtained a mathematics SAT score over 550 in 1986, not a single one indicated an intention to pursue

mathematics in college; of the 10,000 who scored over 450, only 35 indicated a serious interest in mathematics (Kenschaft, AWM Newsletter, 18:5, 1988, 5-7). Chaired by two men, one black and one Hispanic, this committee is beginning a journey similar to that of the Committee on Participation of Women three years ago, and members of the two Committees keep in touch with each other for mutual support.

Gloria Gilmer became the first black female MAA Governor in 1978 as Governor-at-Large for Two-Year colleges. In 1981 the MAA created a position of Governor-at-Large for Minorities. Two women have held this position, Eleanor Green Jones and Sylvia Bozeman.

In 1989-90 the EXXON Education foundation funded a national project, "Making Mathematics Work for Minorities." It encompassed six regional workshops and a national convocation. The AAAS-AMS-MAA Committee on Opportunities in Mathematics for Underrepresented Minorities, chaired by Gloria Gilmer, proposed that the Mathematical Sciences Education Board (MSEB) undertake the project. Marcia Sward, then the Executive Director of MSEB and now of MAA, obtained the EXXON grant and had oversight responsibilities for the project. Many MAA members were involved; in particular, Beverly Anderson of the University of the District of Columbia, was Director.

OTHER MINORITY WOMEN IN MATHEMATICS

There are probably more Asian women mathematicians than African Americans but accurate data are not available about either the sex or ethnicity of MAA members. Furthermore, Asian mathematicians have not organized to draw visibility to their group.

There are fewer Hispanics in mathematics than African Americans. There are very few native American mathematicians, but Claudette Bradley, a native American woman from the University of the Arctic, is active in the AAAS-AMS-MAA Committee on Underrepresented Minorities.

PI MU EPSILON

Though not a part of the MAA, Pi Mu Epsilon, Inc. has been holding its national meeting in conjunction with the MAA summer meetings since 1952. At the turn of the century, many colleges had mathematics clubs for undergraduates, often organized by women students. In 1903, Mary B. Quinlan, a faculty member at Syracuse University, organized a mathematics club to encourage students in mathematics. She

became its secretary. In 1914, Helen Applebee, Purley J. Bentley and Olive E. Jones, three women students from Syracuse, obtained a charter to change the mathematics club to Pi Mu Epsilon Fraternity, Inc., a non-secret, mathematical honor society. They became the first officers of the society.

Helen Mary Barnard and Florence A. Lane were two of the first Councilors of Pi Mu Epsilon (1914-1922), but there were no more women for almost three decades. The next was Ruth Stokes in 1951-1957. Since then, a woman has been a councilor almost every year, with Gloria Hewitt being the first black officer in 1972-75. In 1987, Eileen Poiani of St. Peters College in New Jersey became the first woman president of the 258 chapters across

Eileen Poiani

the country. Poiani was instrumental in changing the name from Pi Mu Epsilon Fraternity, Inc., to Pi Mu Epsilon, Inc. in December, 1989.

The Pi Mu Epsilon Journal was first published in 1949 with Ruth Stokes editing. All subsequent editors have been men. (Poiani, 1979).

THE SECTIONS AND LOCAL ACTIVITY

Immediately upon the founding of the MAA, various parts of the country raced to organize local sections: the Ohio and Kansas Sections organized in 1915, the Iowa Section in 1916, the Rocky Mountain Section in 1917. [Today, 15 of the 29 Sections have student chapters.] There were apparently no women Section chairs in those early years, but women were active at the grass-roots level. In 1939, Sophia H. Levy, mentioned earlier in this chapter, helped organize the Northern California Section. Women who have served as Section Governors are listed in Appendix II.

Paul Schaefer is writing a 50-year history of the Seaway Section (Upper New York State). He reports that he "was struck by the fact that the section has usually had women participating at all levels." Caroline A. Lester of SUNY at Albany was one of the five women signers of the organizing petition of that section in 1940.

Schaefer says, "Caroline Lester was a student of C.C. MacDuffee at the University of Wisconsin, and was one of the first woman Ph.D.'s in mathematics from Wisconsin. To give an indication of how things were in those days--1930's

to early 1950's–she told me then that she was not allowed to teach 'higher level courses' at Albany such as Calculus I until she received her Ph.D.!"

"Ellen Stokes had been a student of Bliss at Chicago, working in Calculus of Variations. She felt that her professional opportunities were so limited in the mathematics department of the 1940's, that she accepted the position of Dean of Women, leaving mathematics for good" (Schaefer, correspondence).

Other women Ph.D.'s maintained their connection with mathematics by becoming high school teachers. One of these is Katherine E. O'Brien, who received her A.M. in mathematics from Cornell University in 1924 and Ph.D. from Brown in 1939. In addition to serving as a referee and reviewer, O'Brien has contributed mathematical poetry to MAA publications for over forty years.

In an effort to obtain more information about the women in the Sections, this author sent a questionnaire to each section Governor in the spring of 1989. Often the male Governor passed the questionnaire on to a woman in the section for responses. for example, Linda Hill from the Intermountain Section wrote that she and Patricia Henry have held almost every office, except Governor. They have been on program committees, panel discussions, and local arrangement committees.

The questionnaire asked "How have the women in your section met challenges–

- of child-rearing responsibilities combined with a career
- reluctance or refusal of schools to hire women
- expectation that women academics serve on multiple committees, teach more, teach lower level courses, and are lower paid
- attitude toward women's ability to excel intellectually
- women's own tendency to consider their contributions and career to be of less importance than those of men."

One contributor responded, "All of us have had to face every one of these issues, and we have done so each alone with those terrible problems. We have apparently different solutions, but the struggle and the barriers, I believe, have been the same for all of us."

She added, "Now that I think of it, there are 'urban legends' about women here...shadowy figures. When I was first hired I was told that there had once been a woman in the department, although no one could tell me her name, or when, who was fired on the spot one day for having worn pants to the campus on a Saturday. Who knows? But that is the way I was

welcomed to this place I had come to work. I doubt that male mathematicians newly-hired here were welcomed the same way."

Another decried the lack of role models. "Women in mathematics at my school have such an indistinct history, you're not aware of any having been here. It gives you the feeling that either you are the first woman who has ever done this, either there have never been any others, or any woman who has ever tried failed. I would have liked to have some evidence that a woman could make it if she wanted to."

A response from Dr. Anne Henriques, Professor Emeritus of the college of Santa Fe, echoes the isolation for women. "I retired in 1971. I was usually the only full-time woman at the University of Utah (1937-1956). There were two of us at the University of New Mexico (1956-1962), and I was the only one at the College of Santa Fe (1961-1971). I attended most meetings, read only one paper. Once I was secretary of a division meeting. I spent a lot of energy running the Utah Council of Teachers of Mathematics and as Secretary Treasurer of Sigma Xi, too. There were no women's issues!" She added that during the Depression, "There were no jobs in 1932, so I stayed on for my Ph.D.–although I had no money." During the war, "I paid off a mortgage with the overtime at the University of Utah teaching in the Army program to train engineers."

J. Larry Marting, from Missouri Southern State College, wrote to tell about another woman pioneer, Martha McCormick. He says, "She began teaching at Joplin Jr. College when the college first opened in 1937 and taught mathematics full-time through 1971-72. She continued teaching part-time for several more years. Throughout those years she provided inspiration, encouragement and excellent instruction. She was the math department. she received the Alumni Merit Award from the University of Missouri-Rolla in 1978. She was not an alumnus of UMR but her reputation as a calculus teacher and as a pre-engineering advisor to countless students who transferred to Rolla earned her the award. She was selected as an Outstanding Educator of America in 1972." He added, "Martha earned an MA from the University of Chicago. I do recall her telling me that she did not feel welcome as a woman in mathematics at that time."

In 1945, Mary E. Haller, from the University of Washington, was one of eighteen petitioners to the MAA for the formation of the Pacific Northwest Section. The first women officers were Marjorie Enneking of Portland State University, who was elected chair-elect in 1980, and Sue Kaplan at Western Washington State University, who began a newsletter for the section in 1982 (Ross, 1987).

Photographed on the occasion of Governor Kean of New Jersey's presentation of Mathematics Awareness Week Proclamation, 1987. Shown here (L. to R.) are: Sister Stephanie Sloyan, Chair of the NJ MAA Section; Susan Marchand, MAA Governor; Agnes Azzolino, President of MATYC for NJ; with Ellen Brockman, President of the Association of Mathematics Teachers of NJ, in front.

Sister Stephanie Sloyan of Georgian Court College was one of the original members of the New Jersey Section in 1956 and has served as both its Chair and its Governor. Her article about women in the New Jersey Section appeared in the September, 1989, *FOCUS* and included a photograph taken by David Boliver, now a member of the Committee on Participation of Women. The photograph had previously been published in *Ms*. Magazine because all four of the leading mathematical officers in New Jersey at that time were women: Sister Stephanie was MAA Chair, Susan Marchand was MAA Governor, Agnes Azzolino was President of the Mathematical Association of Two-Year Colleges of New Jersey, and Ellen Brockman was President of the Association of Mathematics Teachers of New Jersey.

Sister Stephanie, who from 1968 to 1974 had been president of Georgian Court College, and Miriam Cooney (of the committee on Participation of Women) are studying religious women in mathematics and have located about 100 sisters who have earned Ph.D.'s in mathematics. Sister Lucille McKillop, president of Salve Regina College in Newport, RI, and Sister Brigid Driscoll, president of Marymount college in Tarrytown, NY, may be the only other women mathematicians who have served as presidents of colleges. Sister Felice Vaudreuil was secretary of the Wisconsin Section for many years. Green and LaDuke reported 17 women Ph.D.'s with religious vocations in the 1930's. For decades the MAA directories listed all sisters under "Sister" instead of their individual names, mute evidence of the non-communication between MAA leaders and one of its strongest women's contingents.

Domina Eberle Spencer (born in 1920) wrote to describe her mathematical history and that of her sister, Vivian Eberle (born 1907). She wrote that Vivian received her undergradu-

ate and masters degrees from Oberlin College, where Professor Cairns, head of the Mathematics Department and one of the founders of the MAA, introduced her to the Problem Section of the Monthly at an early age.

Deciding that she wanted to go to the Massachusetts Institute of Technology, Spencer recalls walking into Dean Pitre's office to ask about admissions. "There were no college boards, he merely began to talk scholarships. Actually the scholarship they gave me was only a token $50 out of a tuition of $500. They told me girls were bad investments."

Spencer describes the situation in the 1930's:

> My sister wanted very much to teach. Penn said they would have been delighted to hire her if she were a man. Instead, Shohat found her a position in the Census of Mineral Industries in Washington. The pay was about twice what colleges were offering...Vivian had no interest in teaching at women's colleges and those seemed to be the only teaching possibilities...She turned out to be the top woman in the Bureau and the top statistician in the President's Materials Policy Commission. She did teach two statistics courses at American University in the evenings for many years, but the real reason she took the job was to pay for my education at M.I.T. The Depression had hit my father's business very hard and he could only contribute a small part. (By the way, Vivian never had a course in statistics!!)

> So I blithely entered M.I.T. with no formal mathematics and no entrance test. The first fall I walked into the office of Professor H.B. Phillips and asked to take Professor Wiener's course in Fourier Series. Phillips leaned back in his chair and said he was teaching Advanced Calculus (a graduate course) that fall. He said if I could pass that he would give me credit for all my undergraduate mathematics. And that is how I managed to graduate from M.I.T. in 2 years with a bachelor's in physics.

Spencer then took a course with Dirk Struik. "It was the first course I had ever had in which the possibility of new research was even mentioned." She continued to take courses in physics and engineering, but earned her Ph.D. in mathematics with

Domina Eberle Spencer

Struik in 1942 at the age of 21. Since then, Spencer has written approximately 250 papers and nine books. At the age of 70, she is at work on more books and says she is thankful that mandatory retirement has been abolished as she hopes to have the fun of teaching for many more years.

THE 1980's

Dorothy Bernstein

The 1980's was a landmark decade. In 1980, Dorothy Bernstein became the first woman President of the Mathematical Association of America. In 1982, Julia Robinson became the first woman President of the American Mathematical society. Lida K. Barrett became the second woman President of the MAA in 1989, and in January, 1991, Deborah Tepper Haimo became the third woman President of the Mathematical Association of America.

Each November, with revised data reported in May, the AMS Notices provides statistics on graduates. The highlight of the 1988-1989 survey, was that 24% (98 out of 411) of the U.S. citizens receiving their mathematics doctorates are women. For the past six years, this number has been about 20% [10].

Statistics by Green and LaDuke show that women earned 14.3% of the mathematics Ph.D.'s granted to Americans prior to 1940, which is higher than the percentage of all Ph.D.'s granted to women in that period. This increased to about 16% after the 1920 Women's Suffrage Amendment to the Constitution was passed. The numbers then decreased to a low of about 5% in the 1950's due in part to the lack of jobs, the Great Depression, the war, the G.I. Bill (which gave an economic edge to males) and the post-war baby boom [11]. There was a gradual increase to 6% in the 60's, to 13% in 1976-1977 and to 20% in the mid-1980's. As mentioned in the previous paragraph, the percentage jumped to 24% in 1989.

Unfortunately, this impressive percentage increase is due to a drastic decrease in male Ph.D.'s, not a significant increase in females. In 1976-1977, there were 87 women and 602 men, but in 1986-1987 there were only 73 women and 289 men. Thus, although the percentage of women increased from 14% to 25% during this decade, their actual number dropped. The percentage of women graduate students in American mathematics departments did not change as dramatically as these numbers would indicate, however, because in 1989 54% of the mathematics Ph.D.'s awarded by American universities went to foreign students, where the percentage of males is greater than among Americans (*NOTICES*, November 1989). Thus the cohort of women providing peer support among American mathematics graduate students is not as strong as these numbers might suggest.

TABLE 6: U.S. Citizen Doctorates, Male and Female

	Doctorates who are U.S. Citizens	Male	Female	% Female
1973-1974	677	618	59	9%
1974-1975	741	658	83	11%
1975-1976	722	636	86	12%
1976-1977	689	602	87	13%
1977-1978	634	545	89	14%
1978-1979	596	503	93	16%
1979-1980	578	491	87	15%
1980-1981	567	465	102	18%
1981-1982	519	431	88	17%
1982-1983	455	366	89	20%
1983-1984	433	346	87	20%
1984-1985	396	315	81	20%
1985-1986	386	304	82	21%
1986-1987	362	289	73	20%
1987-1988	363	287	76	21%
1988-1989	411	313	98	24%

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THE MAA COMMITTEE ON THE PARTICIPATION OF WOMEN

Seeking to encourage greater participation of women in the MAA, the MAA established the Committee on the Participation of Women in 1987. The activities of the Committee are described elsewhere in this booklet, but one of its major accomplishments has been to assist in getting women appointed to committees and nominating boards. The numbers of women who now serve may seem few, but they represent significant improvements.

In 1988, the chair of the Committee, Patricia Kenschaft, reported, "Women constitute about 23% of the MAA membership, and they are active and visible. Eight of the 38 members holding four or more national committee appointments are women, or 21%. However, only 16% of all committee members are women. If the seven committees that were formed because some groups are underrepresented in mathematics are discounted, only 11% of those serving on the remaining 123 national committees are women" (*FOCUS*, 8:4, 1988).

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10 From 1960 to 1986, women M.D.'s increased from 5.5% to 30.8%; lawyers from 2.5% to 39%; engineers from 0.4% to 12.6%; and dentists from 0.8% to 22.6% (U.S. Bureau of the Census, 1989).

11 A brief description of how the status of women in mathematics has been changed in response to conditions in American society can be found in Duren, 1988.

AWARDS AND PRIZES

Outstanding mathematics achievement is recognized by awards and prizes. While about 23% of the MAA membership is female, less than 11% of Award Committee members are women. Of the four members of the Subcommittee on George Pólya Awards in 1989, Ann E. Watkins was an ex officio member. Deborah Tepper Haimo was one of five on the Committee on the Yueh-Gin Gung/Dr. Charles Y. Hu Award for Distinguished Service to Mathematics. (She is Chair of this Committee in 1990). Judith T. Sutcliffe was one of six on the Edyth May Sliffe Award committee. Lily E. Christ, as Chair of the Committee on the Merten Hasse Prize, was the only female chair. No women were on the committees for the coveted Chauvenet Prize, the Beckenbach Book Prize, the Lester R. Ford Awards, or the Putnam Prize Competition.

The numbers of women recipients of MAA sponsored awards and prizes is appallingly low. The Distinguished Service to Mathematics Award has been awarded 27 times since Mina Rees was its first recipient in 1961. Shirley Hill, who received the award in 1991, is the only other woman to be so honored.

No woman has ever won the Chauvenet Prize, awarded since 1925, for an outstanding expository article on a mathematical topic.

The Earle Raymond Hedrick Lectures began in 1952, and Mary Ellen Rudin has been the only female so honored.

The Lester R. Ford Awards for the outstanding article in the *Monthly* in the previous year began in 1965. Five out of the 114 recipients have been women. Margaret W. Maxfield won the Award in 1968, Olga Taussky Todd in 1971, Cathleen S. Morawetz in 1980, Judith Grabiner in 1984, and Joan Cleary in 1987.

Four out of the 24 winners of the Carl B. Allendoerfer Awards for outstanding articles in *Mathematics Magazine* have been women since the Award began in 1977: Doris J. Schattschneider in 1979, Marjorie Senechal in 1982, and Judith Grabiner in 1984 and 1989.

The George Pólya Award has been presented to women five times in the 26 years since it began in 1977. These winners were Anneli Lax, 1977; Freida Zames, 1978; Ruma Falk and Maya Bar-Hillel, 1984; Constance Reid, 1987; and Beverly L. Brechner (shared with John C. Mayer), 1989. Brechner is on the 1990 Pólya Award Committee.
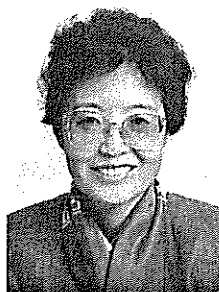
Lily Christ

Of the thirty-three winners of the Certificate of Meritorious Service to Sections, the three women winners were Dorothy L. Bernstein, Maryland-DC-Virginia Section in 1985; Lily E. Christ, Metropolitan New York Section in 1986; and Aughtum S. Howard, Kentucky Section in 1988. Nura Turner, 1978, and Hope Daly, 1983, are winners of the Certificate of Merit Award, which has been made seven times.

Alice C. Beckenbach, who has attended almost every national MAA meeting since 1930, established the Beckenbach Book Prize in 1986 in memory of her husband, Edwin F. Beckenbach. This prize has been awarded three times. The Merten M. Hasse Prize was awarded twice. Neither of these prizes has gone to women.

A few prizes are named in honor of women. There is the Emmy Noether Research Instructorship, the ACM Grace Murray Hopper Award, and the Amelia Earhart Fellowship for aerospace studies.

In 1988, the Edyth May Sliffe Award was established to honor outstanding high school teachers. In 1990, AWM established the Alice T. Schafer Award for excellence in mathematics by a woman undergraduate and the Louise Hay Award for Contributions to Mathematics Education.

PUBLICATIONS

In the decade following World War II, four women served as associate editors of the *Monthly*. Since 1972, at least one of the 13 associate editors of the *Monthly* has always been a woman. Since 1987, Louise Hay, Joan P. Hutchinson, Anita E. Solow, Judith V. Grabiner and Constance Reid have served as associate editors. Donna Beers succeeded Hay in January, 1990, after Hay's untimely death in October 1989. However, no woman has served as editor-in-chief since the *Monthly's* inception in 1894.

In addition to the *Monthly*, the MAA publishes *Mathematics Magazine*, *The College Mathematics Journal*, and its newsletter *FOCUS*. Women constitute less than 12% of the authors of each MAA journal. Only one major article of the *Monthly* in the years 1984-1988 was written by a woman (Kenschaft, *FOCUS*, May-June 1988). To help remedy this situation, the Committee on the Participation of Women sponsored a panel discussion and also a workshop at the 1989 national meeting on how to break into print in mathematics (Rosamond).

Mathematics Magazine was started in 1926, and the MAA began publishing it in 1960. In 1981, Doris Schattschneider became its first woman editor, thereby the first woman editor of any MAA journal. Martha Siegel became the second female editor of *Mathematics Magazine,* in January 1991.

Martha Siegel

Ann Watkins

Ann Watkins, co-editor with her husband William, is the first woman editor of the *College Mathematics Journal,* begun in 1970. In 1990, Katherine A. Franklin, Elizabeth J. Teles, and Kathie A. Yoder were three of the thirteen associate editors.

FOCUS, THE NEWSLETTER OF THE MATHEMATICAL ASSOCIATION OF AMERICA, was first published in March 1981 with Marcia Peterson Sward as its first editor. She remained editor as long as she was Associate Director of the MAA, through the January-February 1986 issue. Susan Forman of Bronx Community College became the first woman to chair the *FOCUS* Editorial Committee with the March-April 1989 issue.

Women have contributed financially to support the publications of the MAA. Alice C. Beckenbach's gift has been noted. The first MAA series, the Carus Mathematical Monographs, was made possible by a series of gifts from Mrs. Mary Hegeler Carus in 1921. None of the Carus Monographs has been written by a woman. In 1976, Carol R. Brink endowed the Raymond W. Brink Selected Mathematical Papers series in honor of her late husband, Raymond W. Brink, nineteenth President of the MAA. Miss Bessie Houck bequeathed her estate to the MAA and established the Jacob Houck Memorial Fund in honor of her father.

Mary P. Dolciani was an extremely successful author of high school texts, a long-time MAA member who served as a Visiting Secondary School Lecturer and a Member-at-Large of the Board of Governors. She was the first woman member of the United States Commission on Mathematical Instruction

Mary Dolciani
Photo Courtesy of Houghton Mifflin

and was a Governor of the New York Section. In 1974, she endowed the Dolciani Mathematical Expositions. The MAA headquarters, named in her honor after she donated a significant amount for its purchase, is known as the Dolciani Mathematical Center. In 1974, the board of Governors bestowed upon her an honorary Life Membership in recognition of her many services and contributions to the mathematical community, and to the MAA in particular (Rosenberg, 1974).

CONFERENCES

The MAA, AWM, and AMS hold joint meetings each January (about 4000 attended in 1990) and smaller summer meetings in August. Judith D. Sally, Northwestern University, presented one of the five MAA invited addresses at the 1990 national meeting. The four joint AMS-MAA invited addresses were all given by males, but Sun-Yung Alice Chang, University of California, Los Angeles, presented one of the six AMS invited addresses. The September, 1988, *AMS NOTICES* reported that women constitute 14% of the membership but are speakers for only 6% of the invited hour addresses or special sessions.

Activism by women can make a difference in the numbers of invited speakers at conferences. The International Congress of Mathematicians (ICM) in Helsinki in 1978 had no women speakers. A resolution was passed at a large international meeting at the congress organized by AWM urging that this situation be rectified at the 1982/3 ICM in Warsaw, and four women were invited to speak there.

However, the preliminary list for the 1986 ICM-Berkeley again revealed no women research mathematicians. Pressure was applied from various segments of the community, with the result that three women research mathematicians were on the final program. In 1989, the American Mathematical Society celebrated its Centennial with great fanfare. Karen K. Uhlenbeck, a member of the National Academy of Sciences, of the University of Texas at Austin was the only woman among the 21 invited speakers.

A minicourse on how to teach a course or seminar on women in mathematics was first offered at the Boulder meeting in 1989 and again in Louisville in 1990. The presenter, Miriam Cooney, of Saint Mary's of Notre Dame, Indiana, has pioneered this course at her own institution since 1982. She gives those attending the MAA minicourse a bibliography and expanded syllabus, as well as an experience of "process learning." Both minicourses were registered to capacity. A third of the participants said they plan to offer a similar course. The feminist literature is increasing in mathematics, but not as rapidly as in other fields.

The MAA sends representatives to other organizations. The Conference Board of the Mathematical Sciences did not have a female member of the Executive Committee in 1988-89, but since the Council consists of presidents of member societies, members in 1990 included MAA President Lida K. Barrett, AWM President Jill Mesirov, and Operations Research Society of America President, Judith S. Liebman. The MAA representative to the American Association for the Advancement of Science (AAAS) is Ruth A. Bari, and to the U.S. National Committee for Mathematics (NAS-NRC) is Sun-Yung Alice Chang.

Women and minorities was one of the three main issues discussed at the March/April 1989 workshop of the Conference board of the Mathematical Sciences (CBMS). AWM was an invited participant.

Three of the five U.S. Delegates to the International Congress of Mathematicians were women in 1990: Lenore Blum, Sun-Yung Alice Chang, and Linda Keen.

CONCLUSION

At the January, 1990, Joint MAA-AWM-AMS meeting, the MAA Committee on Participation of Women produced skits about microinequities (the scripts appear elsewhere in this booklet) that actually happened at the August, 1989 summer meeting. The fact that men and women were not afraid to act out these subtle discriminations, and that a large, enthusiastic audience recognized and was able to laugh at them, indicates increased awareness of our unconscious behavior.

Alice T. Schafer

In January 1989 *Everybody Counts— A Report to the Nation on the Future of Mathematics Education* was published by the Mathematical Sciences Education board, the board on Mathematical Sciences, and their joint committee on "The Mathematical Sciences in the Year 2000." Alice T. Schafer, in her review of *Everybody Counts* for the *AWM Newsletter*, stated, "For the first time in my memory, in a report written by a group the majority of which is male, the following belief is expressed:'Gender differences in mathematics performance are predominantly due to the accumulated effects of sex-role stereotypes in family, school, and society.' What is being said here is that women should now be encouraged to continue in the mathematical sciences! (Clearly, a student's ability in mathematics should not be judged by sex, race, religion, etc., only by the individual's capability.)"

There was a time when some women had no regular position, and thought it was natural. There was a time when some women felt that being in favor of women's rights diluted their accomplishments. In addition to a change in attitude, there is solidarity among us now, and networking. It feels as if we are locked arm in arm, and if some women tire in the face of discrimination, the community will hold them up. We are all encouraging each other and celebrating each other's successes. The more and louder we celebrate, the more we will attract other women into mathematics.

*Frances Rosamond is Chairperson of the Department of Mathematics at National University, a private university serving working adults with eleven learning centers in California, Southern Nevada and Costa Rica. She is active in the MAA, serving on four committees. Her research focuses on the connections between cognition, emotions, and belief structures. She earned her Ph.D. from Cornell University under David Henderson and Robert Gowin.

APPENDIX I

SOME IMPORTANT WOMEN IN MATHEMATICS OF THE 80's & 90's

Lida K. Barrett: Second woman President of the Mathematical Association of America (1989-1991). She serves on the Mathematical Sciences for the Year 2000 Project, on the Conference board of the Mathematical Sciences and on the Council of Scientific Society Presidents.

Dorothy Bernstein (1914-1988): First woman President of the Mathematical Association of America (1979-1981). Bernstein worked to have more women represented on MAA committees. She was on the Buildings Site committee in 1975, and was instrumental in locating a home for the MAA headquarters in Washington, D.C.

Lenore Blum: First woman editor of International Journal of Algebra and Computation (1989-1991); Co-founder and co-director of Math-Science Network Expand Your Horizons Program; an invited speaker and delegate to the International Mathematical congress 1990; Vice President, AMS (1990-91).

Lenore Blum

Iris Carl: President of NCTM (1990-1992). Frye and Carl are the first successive women President of the NCTM, and Carl is the first black woman president of NCTM. Iris Carl was the 1988 President of the National Council of Supervisors of Mathematics.

Iris Carl

Miriam Cooney: Taught the First MAA mini-courses about teaching courses on "Women and Mathematics," in August, 1989 and January, 1990.

Shirley Frye: President of the National Council of Teachers of Mathematics (1988-1990).

Shirley Frye

Gloria Gilmer: First Chair of the AAAS-AMS-MAA Committee on Opportunities in Mathematics for Underrepresented Minorities (1985-1992). She is also the first president of the International Study Group on Ethnomathematics (1985–).

Evelyn Boyd Granville: First black woman mathematician to receive an honorary doctorate (1989 from Smith College). In 1949 she and Marjorie Lee Browne were the first black women to earn doctorates in mathematics.

Deborah Tepper Haimo: President of the MAA in 1991. Thus, Barrett and Haimo are the first women presidents of the MAA elected successively. Haimo was first vice-president (1986-87) and chaired the committee that selected Marcia P. Sward as the MAA's new Executive Director.

Shirley Hill: first woman president of the NCTM (1978-1980). Also, first Chair of the Mathematical Sciences Education Board (1985-1990).

Shirley Hill

Grace Brewster Murray Hopper: First woman to be promoted to Commodore in the U.S. Navy (1985). She has since become an Admiral. The "Mother of COBOL."

Sandra Keith: Coordinator of the first National Conference on Women in Mathematics at St. Cloud State University, November 1989.

Patricia Clark Kenschaft: First Chair of the MAA Committee on Participation of Women (1987-1993).

Carol Lacampagne: First Chair of the Joint Mathematical Committee on Women (1984-1987). Second Director of WAM (1981-1988).

Joan Leitzel: First woman Director of the Division for Materials Development, Research, and Informal Science Education of the National Science Foundation (1990).

Joan Leitzel

Cathleen Synge Morawetz: First woman to head a United States mathematics institute; she became Director of the Courant Institute of Mathematical Sciences in 1984. First woman Gibbs Lecturer (the 54th Gibbs lecturer) in 1981. Winner of the Lester R. Ford Award of the MAA (1980).

Cathleen Morawetz

Eileen L. Poiani: First woman President of Pi Mu Epsilon, Inc., the National Honorary Mathematics Society (1987). first national Director of WAM, the Lecturership Program of MAA. First woman representing the MAA selected to be the United States National Representative to the General Assembly and Head of the American Delegation to ICME-6 in 1988.

Mina Rees: First woman mathematician to have a library dedicated in her honor, the Mina Rees Library of the Graduate School and University Center of the City University of New York (dedicated 1985). First recipient of the MAA Award for Distinguished Service to Mathematics (1961).

Julia Bowman Robinson

Julia Bowman Robinson (1919-1985): First woman President of the American Mathematical Society (1982). First woman to be elected to the Mathematics Section of the National Academy of Sciences (1976). Second woman to be invited to deliver the Colloquium Lectures of the AMS (1980). First woman mathematician to receive a MacArthur Foundation Fellowship (1983).

Linda Rothschild, then President of AWM, and Julia Robinson, President of AMS, accepted a first: a citation by the MAA "in honor of those who have furthered the progress of mathematics by enhancing significantly the status of women in mathematics," at the joint annual meetings in 1984.

Mary Ellen Rudin: First woman U.S. member and also Chair of the official U.S. Delegation to the International Mathematical Union (IMU) in Berkeley, 1986. First Grace Chisholm Young Professor of Mathematics (1981) at the University of Wisconsin. Vice-President of the AMS (1980-81). Member of the National Research Council (since 1983). Member of the editorial board of *Topology and its Applications* (since 1976).

Alice T. Schafer: Planned the first tour of women mathematicians to the People's Republic of China for 1989. After violence in China caused the tour to be cancelled at the last minute, she led a tour of 18 women and 2 men (both members of AWM) in 1990.

Doris Schattschneider

Doris Schattschneider: First woman Editor of *Mathematics Magazine* (1981-1985). First woman to deliver Pi Mu Epsilon's J. Sutherland Frame Lecture (1988). (The second was Jane Cronin Scanlon in 1989.)

Judith Sunley
Photo courtesy of Joan Wexler

Judith S. Sunley: First woman Division Director of Mathematical Sciences of the NSF, 1987. Members of the advisory board for Mathematical Sciences include Susan Montgomery, Julia Knight, Mary Wheeler and Chuu-lian Terng. (Currently the Division of Astronomy also has a female Director, Dr. Laura Bautz.)

Marcia Sward: First woman Executive Director of the MAA (in 1989). She had been Associate Director from 1980-1985. First Executive Director of the Mathematical Sciences Education Board. Sward's Ph.D. is from the University of Illinois with a specialty in partial differential equations.

Marcia Sward

Karen Uhlenbeck: Second woman mathematician to be elected to the National Academy of Sciences. (There are only 57 female members.) Second woman mathematician to receive a MacArthur Foundation Fellowship. Third to be invited to deliver the AMS Colloquium Lectures (1985). The only woman to be invited to speak at the AMS Centennial in Providence. Named one of America's 100 Most Important Women on the Eve of the 1990's by the editors of *Ladies' Home Journal* (November 1988).

Ann Esther Watkins: First Woman Editor of the *College Mathematics Journal* (1988-1992).

APPENDIX II

WOMEN OFFICERS OF THE MAA
1916-1947

VICE PRESIDENTS

1920	Helen A. Merrill, Wellesley College
1927	Clara E. Smith, Wellesley College

ADDITIONAL MEMBERS OF THE BOARD

1917-19 Helen A. Merrill, Wellesley College
1918-20 Elizabeth B. Cowley
1923-25 Clara E. Smith, Wellesley College
1936-38 Mary Emily Sinclair
1945-47 Sophie Levy McDonald, U.C. Berkeley

1948	ASSOCIATE SECRETARY 1948-57 Edith R. Schneckenburger, University of Buffalo
1950	GOVERNOR AT LARGE 1950-52 Marie J. Weiss, Newcomb, Kentucky Autumn School, Wesleyan College
1951	2ND VICE PRESIDENT 1951-52 Jewell H. Bushey, Hunter College
1957	SECTIONAL GOVERNOR 1957-60 Metropolitan N.Y., Jewell H. Bushey, Hunter College

1961   SECTIONAL GOVERNOR
1961-64 Upper N.Y. State, Harriet F. Montague,
SUNY Buffalo
1961-64 Md.-DC-VA., M. Gweneth Humphreys,
Randolph-Macon Women's College
1963   2ND VICE PRESIDENT
1963-64 Mina S. Rees, City Univ. of N.Y.
1965   SECTIONAL GOVERNOR
1965-68 Md-DC-VA, Dorothy L. Bernstein,
Goucher College
1967   SECTIONAL GOVERNOR
1967-70 Northeastern, Grace E. Bates, Mt Holyoke
College
1968   SECTIONAL GOVERNOR
1968-71 Louisiana-Miss., L. Virginia Carlton,
Centenary College
1969   GOVERNOR AT LARGE
1969-71 Mary P. Dolciani, City Univ. of N.Y.
1972   1ST VICE PRESIDENT
1972-73 Dorothy L. Bernstein, Goucher College
GOVERNOR AT LARGE
1972-74 Shirley A. Hill, Univ. Missouri, Kansas
City
SECTIONAL GOVERNOR
1972-75 Northern Calif., Mary V. Sunseri, Stanford
Univ.
1973   2ND VICE PRESIDENT
1973-74 June P. Wood, South Texas College
GOVERNOR AT LARGE
1973-75 Mary E. Rudin, Univ. Wisconsin, Madison
1974   GOVERNOR AT LARGE
1974-76 Deborah T. Haimo, Univ. Missouri, St.
Louis
SECTIONAL GOVERNOR
1974-77 Iowa, Elsie C. Muller, Morningside Col-
lege
1975   2ND VICE PRESIDENT
1975-76 Betty J. Hinman, Downtown Coll. Univ.
of Houston
GOVERNOR AT LARGE
1975-77 Mary B. Williams, Ohio State Univ.
SECTIONAL GOVERNOR
1975-78 Nebraska, Mildred L. Gross, Doan
College
1976   SECTIONAL GOVERNOR
1976-79 New Jersey, Eileen L. Poiani, St. Peter's
College
1977   GOVERNOR AT LARGE
1977-79 Marjorie L. Stein, U.S. Postal Service
SECTIONAL GOVERNOR
1977-80 So. Calif., Alice A. Huffmon-King, Cal
State Poly Univ.
1978   PRESIDENT ELECT, MEMBER OF THE EX-
ECUTIVE AND FINANCE COMMITTEE
1978-79 Dorothy L. Bernstein, Goucher College

GOVERNOR AT LARGE
1978-80 Katherine P. Layton, Beverly Hills H.S.
1979   PRESIDENT, MEMBER OF THE EXECUTIVE
AND FINANCE COMMITTEE
1979-81 Dorothy L. Bernstein, Goucher College
2ND VICE PRESIDENT
1979-80 Jacqueline C. Moss, Paducah Community
College
GOVERNOR AT LARGE
1979-81 Gloria F. Gilmer, Milwaukee Area Tech.
College
SECTIONAL GOVERNOR
1979-82 Kentucky, Jacqueline C. Moss, Paducah
Commun. Coll.
1979-82 Northeastern, Anne F. O'Neill, Weaton
1979-82 Seaway, Mabel D. Montgomery, SUNY
Buffalo
1980   PAST PRESIDENT, MEMBER OF THE EXECU-
TIVE AND FINANCE COMMITTEE
1981-86 Dorothy L. Bernstein, Brown Univ.
ASSOCIATE DIRECTOR
1980-85 Marcia Sward
GOVERNOR AT LARGE
1980-82 Susan J. Devlin, Bell Telephone Lab
SECTIONAL GOVERNOR
1980-83 Florida, Beverly L. Brechner, Univ. of
Florida
1980-83 Michigan, Deila Koo, Eastern Michigan
Univ.
1981   EDITOR OF MATHEMATICS MAGAZINE
1981-85 Doris J. Schattschneider, Moravian College
GOVERNOR AT LARGE
1981-83 Martha Zelinka, Weston H.S.
SECTIONAL GOVERNOR
1981-84 Kentucky, Martha F. Watson, Western
Kentucky Univ.
1981-84 Northern Calif., Jean J. Pederson, Univ. of
Santa Clara
1982   GOVERNOR AT LARGE
1982-84 Marilyn J. Zweng, Univ. of Iowa
SECTIONAL GOVERNOR
1982-85 Kansas, Sister Jo Ann Fellin, Benedictine
College
1982-85 Seaway, Violet H. Larney, SUNY at Al-
bany
1982-85 Southwestern, Ivey C. Gentry, Wake
Forest Univ.
1983   GOVERNOR AT LARGE
1983-85 Eleanor Green Jones, Norfolk State Univ.
SECTIONAL GOVERNOR
1983-86 Louisiana-Miss., Carol B. Ottinger, Miss.
Univ. for Women
1984   ELECTED MEMBER OF FINANCE
COMMITTEE
1984-87 Lida K. Barrett, Mississippi State Univ.

GOVERNOR AT LARGE
1984-86 Mary Harley Kruter, Fairfax County
Schools
1985 SECTIONAL GOVERNOR
1985-88 Susan G. Marchand, Kean College of N.J.
1986 1ST VICE PRESIDENT
1986-87 Deborah Tepper Haimo, Univ. Missouri,
St. Louis
2ND VICE PRESIDENT
1986-87 Ann Watkins, Los Angeles Pierce College
SECTIONAL GOVERNOR
1986-89 East. Penn. & Del., Doris J.
Schattschneider, Moravian C.
1987 GOVERNOR AT LARGE
1987-89 Judith E. Broadwin, Jericho H.S.
1988 PRESIDENT ELECT
1988-89 Lida K. Barrett, Mississippi State Univ.
GOVERNOR AT LARGE
1988-90 Marjorie L. Stein, U.S. Postal Service
SECTIONAL GOVERNOR
1988-91 Allegheny Mt., Barbara T. Faires,
Westminster College
1988-91 Missouri, Shirley M. Huffman, S.W.
Missouri State U.
1988-91 New Jersey, Stephanie M. Sloyan, Ga.
Court College
1989 PRESIDENT
1989-90 Lida K. Barrett, Mississippi State Univ.
GOVERNOR AT LARGE
1989-91 Sylvia T. Bozeman, Spellman College
SECTIONAL GOVERNOR
1989-92 Illinois, Linda R. Sons, Northern Illinois
Univ.
1989-92 Iowa, Anne K. Steiner, Iowa State Univ.
1989-92 So. California, Carol Adjemian, Pepperdine
Univ.
1990 PRESIDENT ELECT
1990-91 Deborah Tepper Haimo, Univ. of Mis-
souri, St. Louis
GOVERNOR AT LARGE
1990-92 Dorothy Wendt, Grissom H.S.
1991 PAST PRESIDENT
1991 Lida K. Barrett, Mississippi State Univ.
PRESIDENT
1991 Deborah Tepper Haimo, Univ. of Missouri,
St. Louis

APPENDIX III

THE EMMY NOETHER LECTURES

Descriptions of the mathematicians and their lectures can be found in "The Emmy Noether Lecturers," prepared by Lori Kenschaft and published by AWM, 1988, Wellesley, MA.

1980 F. Jessie MacWilliams (1917-1990), "Survey of Coding Theory"
1981 Olga Taussky Todd, "Many Aspects of Pythagorean Triangles"
1982 Julia Robinson (1919-1985), "Functional Equations and Arithmetic"
1983 Cathleen Morawetz, "How do Perturbations of the Wave Work?"
1984 Mary Ellen Rudin, "Paracompactness"
1985 Jane Cronin Scanlon, "Model of a Cardiac Fiber Problem in a Singularly Perturbed System"
1986 Yvonne Choquet-Bruhat*, "On Partial Differential Equations of Gauge Theories and General Relativity"
1987 Joan S. Birman, "Studying Links via Braids"
1988 Karen K. Uhlenbeck, "Moment Maps in Stable Bundles: Where Analysis, Algebra and Topology Meet"
1989 Mary F. Wheeler, "Large Scale Modeling of Problems Arising in Flow in Porous Media"
1990 Bhama Srinivasin, "The Invasion of Geometry into Finite Group Theory"

*The first woman elected to the French Academy of Sciences in its 300-year history. Even Marie Curie had been rejected.

APPENDIX IV

PRESIDENTS
ASSOCIATION FOR WOMEN IN MATHEMATICS

1971-73 Mary Gray
1973-75 Alice T. Schafer
1975-79 Lenore Blum
1979-81 Judy Roitman
1981-83 Bhama Srinivasan
1983-85 Linda Rothschild
1985-87 Linda Keen
1987-89 Rhonda Hughes
1989-91 Jill Mesirov

APPENDIX V

SALARIES

The lack of equity in employment and salaries has been and continues to be grim. The 1989 AMS Survey (*Notices*, May 1989) reports that women comprise 24% of the U.S. citizens receiving doctorates, but only 16% of those obtaining employment in doctorate-granting institutions; that is, 16% of the new doctoral hires in U.S. doctorate-granting departments were women. The percentage of women full-time faculty in institutions granting doctoral degrees is only about 6%.

Betty M. Vetter, in the May 1989 AAAS Observer, tells us that women scientists, "continue to be paid considerably less than men in the same field and at the same experience level." Salary differences begin with the first job and the gap widens with years of experience. Forty percent of Ph.D. women have ten or more years of experience. Vetter says that "salaries of full-time women doctoral scientists cease to rise after 25 years of experience, although male salaries continue upward for another decade." Unemployment is almost twice as high for women doctoral scientists and engineers as for men. Men are considerably more likely than women to be tenured or on tenure track. As graduate students, women tend to be self-supporting while men have research or teaching assistantships or grant support.

One of the most insidious myths is that most women are supported by their husbands. This is generally not true and women continue to struggle to support themselves and/or dependents. This lack of financial support may contribute to the attrition of women from graduate schools [12]. The May-June 1989 *AMS NOTICES* reports that 47% of the junior and senior mathematics majors are women, yet they are less than 20% of the Ph.D. holders. In 1980, President Carter signed the Women in Science and Technology Equal Opportunity Act that called for a 125 million dollar program under the National Science foundation (NSF) to support women. President Reagan decreased the funding, but NSF still has programs that offer support to women: Standard Research Grants, Research Initiation Awards, Research Planning Grants, Career Advancement Awards, and the Visiting Professorships for Women. In addition there are the Minority Research Initiation Awards and the Facilitation Awards for Handicapped Scientists and Engineers.

The July-August, 1989, *AWM Newsletter* reported that twelve of the ninety-one Sloan fellows in sciences and economics are women. "Albert Rees, President of the Sloan Foundation, said, 'We are most pleased that there are twelve women among the new fellows, the largest number in more than decade. We hope that this indicates a longer-run increase in the number of outstanding women attracted to academic careers in science.'" (could it be that providing support for women may attract them to these careers and enable them to participate?)

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12 R.G.D. Richardson, writing in 1935, used a variety of measures to conclude that fellowships stimulate individual research.

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